A NEW DASYCLADACEAN ALGA FROM THE PALAEOCENE OF KURDISTAN

by GRAHAM F. ELLIOTT

ABSTRACT. *Hamulusella sedalanensis* gen. et sp. nov., a Tethyan Palaeocene alga (Dasycladaceae) from Kurdistan shows an external morphology of serial conical segments known in other dasycladaceans, but has an unusual internal primary branch-structure distinguished by a short proximal extension below the stem-cell connection.

THE calcareous algae of the Palaeocene of the western Tethys, both red and green families, form a rich and varied microflora. The new genus described below is an addition to the Dasycladaceae of the Middle East (Elliott 1968), an assemblage whose members show considerable variety in structure. Although small and rare, the peculiarities of the new dasycladacean show yet another variant on the basic structures of the family.

SYSTEMATIC DESCRIPTION

Order DASYCLADALES
Family DASYCLADACEAE s.l.
Tribe INCERTA SEDIS
Genus HAMULUSELLA gen. nov.

Diagnosis. Calcified, truncated-cone-shaped serial segments, the distal ends wider; each with about twelve primary branches showing a short proximal portion below the connection with the stem-cell and a longer distal portion above it; branches opening to apertures at the distal edge.

Type species. H. sedalanensis sp. nov.; Palaeocene of north-eastern Iraq and western Iran. (Latin *hamulus*, a little hook; a reference to the outline of the branches.)

Hamulusella sedalanensis sp. nov.

Plate 73, figs. 1–4

Description. The species is known only from random but distinctive cuts in thin-section. They indicate small, truncated-cone-shaped serial calcified segments, circular in transverse section, with exteriorly concave outer walls so that in each unit the upper or distal diameter is larger than the lower or proximal diameter. The central tubular stem-cell cavity varies only slightly in diameter, so that the thick calcified 'wall' increases in width distally in each unit. This increase varies widely between segments of different sizes, perhaps indicating different positions in the original thallus. Because of the limited evidence, qualified by the obliquity of some of the sections, all available measurements are set out in Table 1.

[Palaeontology, Vol. 21, Part 3, 1978, pp. 687–691, pl. 73.]

TABLE 1. Dimensions of segments of *Hamulusella* (in microns).

Example	1	2	3	4	5	6	7	8
Height	225	225	-	315	342	-	-	360
Diameter (max.)	270	270	324	522	531	630	1017 (est.)	630+
Diameter (min.)	234	216	-	336	336	342		
Stem-cell diameter	99-126	99-126	117	135-153	126-144	180	297	-
Branch thickness	27-27+	-	-	27-54	27-54	-	45-72	
Stem-cell connection diameter	18	-	-	27	18	-	27	

Within the thick wall each segment contains about twelve primary branches. In each the short communication with the stem-cell occurs at about a quarter of the segment height from the base; the lower part of the branch is directed downwards (proximally) into a short cul-de-sac while the distal part curves up and outwards, widening to a maximum just within the outer distal rim of the unit, before reaching the outside through an aperture probably on or adjacent to the rim. In the largest example there is a suggestion near the aperture of branch-division into secondaries, but this is not certain and the appearance may be due to preservation. Such division was, however, very likely in life.

Not more than two conjoined segments have been seen, but there probably would have been many more in life, as seen in living green algae including the dasycladacean *Cymopolia*, to form at least a uniserial thallus and possibly a multiserial one, though there is no evidence at all of the latter.

EXPLANATION OF PLATE 73

Figs. 1-4. Thin-sections of *Hamulusella sedalanensis* gen. et sp. nov., from the Kolosh Formation (Palaeocene-Lower Eocene) of Sedalan, Sulaimaniya, Iraq. All ×100. 1, vertical section of two segments, showing the distinctive hook-like branch-form and stem-cell connection; Syntype V.41606. 2, oblique-transverse section; Syntype V.32492. 3, part of large example showing presumed incipient branch-division at the aperture of the large lower branch (top left); the apparent *basal* connection of the upper branch with the stem-cell (upper centre) is an artefact due to crystal boundaries obliquely cut; the true connection does not occur in the plane of section; V.41606. 4, oblique section of two segments; the central radial structure is that of a segment of the codiacid *Ovulites morelleti* Elliott, adventitiously wedged in the stem-cell cavity of *Hamulusella*; V.41606.

1

2

3

4

ELLIOTT, *Hamulusella*

Material. Syntypes, British Museum (Natural History), Department of Palaeontology, nos. V.41606, V.32492 (Pl. 73, figs. 1, 2); from the Kolosh Formation (Palaeocene–Lower Eocene); 1·5 km south-west of Sedalan, 48 km north-west of Sulaimaniya, north-east Iraq. Further thin-sections from the same locality and horizon are present on the same two slides. Other material comprises a thin-section (no. V.20744) from Palaeocene–Lower Eocene beds, south-west of Gahvāreh, 64 km west of Kermanshah, Iran.

Associated biotas. At Sedalan *Hamulusella* occurs rarely in a richly algal rock with *Belzungia silvestrii* (Pfender) Massieux, *Clypeina* sp., *Elianella elegans* Pfender and Basse (*Parachaetetes asvapatii* Pia auct., see Hagn and Ott 1975), *Furcoporella diplopora* Pia, *Halimeda nana* Pia, *Jania* sp., *Neomeris* sp., *Ovulites morelleti* Elliott, *Pagodaporella wetzeli* Elliott, *Terquemella* cf. *globularis* Elliott. The foraminifer *Lockhartia diversa* Smout, corals and sponges are also present.

In the Gahvāreh sample *Hamulusella* occurs with *Clypeina merienda* Elliott, *Cymopolia kurdistanensis* Elliott, *Ethelia alba* (Pfender) Massieux and Denizot (*Pseudolithothamnium*), *Elianella elegans*, *Furcoporella diplopora*, *Neomeris* sp., and corals.

Remarks. Both samples are from old collections. The Iraqi samples, collected by E. W. K. Andrau about 1926–1927, came from 1·5 km south-west of Sedalan (45° 00′ E., 35° 45′ N.; unpublished report), from what would now be called near the top of the green-rock sands of the Kolosh Formation. However, the rich microflora and perhaps the matrix, indicate a tongue or development of the Sinjar Formation facies of the same age (see Van Bellen (1959, p. 279) and Elliott (1968, p. 96) for the stratigraphical and algal relations respectively of these two formations). The Iranian sample was collected by B. K. N. Wyllie in 1919. As later mapped (British Petroleum Company, Ltd. (1956), map sheet north 1–38) Gahvāreh (46° 25′ E., 34° 19′ N.) is very close to the Maestrichtian–Eocene boundary, i.e. a similar situation to Sedalan. From Sedalan to Gahvāreh is about 210 km south-east along the strike of the Zagros Mountains.

Discussion. The distinctive character of this little dasycladacean is its branch-form. Although calcified verticils of simple primaries occur in various genera, e.g. the Cretaceous *Acroporella* (which when well preserved shows terminal branch-division as suggested for *Hamulusella*; see Praturlon and Radoičić 1974), such branches are usually directed horizontally or distally. The proximally directed angle or elbow of *Hamulusella* is most unusual. In genera with elaborately divided branches part may occasionally be proximal to the stem-cell connection, e.g. the Permian *Imperiella* (Elliott and Süssli 1975), but this is not really comparable.

No remains of reproductive bodies have been seen in *Hamulusella*. Both the elbow and subapertural swelling could be connected with this, but there is no evidence preserved.

In external morphology, by contrast, this alga repeats a growth form known from the Palaeozoic, Mesozoic, and Cenozoic; Kochansky-Devidé and Gušić (1971) have drawn attention to this phenomenon in dasycladaceans generally. *Hamulusella* is very similar to the Permian *Salopekiella* (Milanović 1965): the resemblance in near-vertical section is homoeomorphic. *Salopekiella* has, however, two verticils per segment of straight, usually outwardly and distally directed branches. The chances of a Permian genus, known from only one Mesozoic record, reappearing in the Palaeocene are slight. *Gymnocodium nummuliticum* Pfender, an alleged occurrence of a Permian genus in the Egyptian Eocene, was re-examined by Massieux (1966, p. 144) who interpreted it as probably very badly preserved *Halimeda*, a largely Cenozoic genus. My own record of *G. nummuliticum* from the Hadhramaut (Elliott *in* Beydoun 1964, p. 72) referred to just such a specimen and added nothing to knowledge of structure.

Another alga which *Hamulusella* somewhat resembles is the rather doubtful *Clypeina parvula* as described by Carozzi (1948) from the Jurassic. Here, however,

the segments are conspicuously fluted externally, and the internal content of the alleged fertile whorls is again quite different.

C. elliotti Beckmann and Beckmann (1966, Segonzac 1976), from the Palaeocene–Lower Eocene of Cuba, is of similar size and general morphology, but the adjacent sporangial cavities of fertile whorls occupy more space within the segments than do the branches of *Hamulusella*; also they do not have the distinctive form of the latter. In *C. elliotti* the distal peripheries are stellate due to slight external vertical fluting of the segments.

The distinctive simplicity of *Hamulusella* makes it difficult to refer to a tribe, until such time as this system, if continued, is revised for all the post-Palaeozoic dasycladaceans. Like the accompanying *Furcoporella*, it is at present best regarded as *incerta sedis* within the Dasycladaceae.

Acknowledgements. I thank Mr. M. Crawley and Mr. P. V. York, both of the British Museum (Natural History), for preparation of the table and photography for the plate, respectively.

REFERENCES

BECKMANN, J. P. and BECKMANN, R. 1966. Calcareous algae from the Cretaceous and Tertiary of Cuba. *Schweiz. palaeont. Abh.* **85,** 1–45.

BEYDOUN, Z. R. 1964. The stratigraphy and structure of the Eastern Aden Protectorate. *Bull. Suppl. Overseas Geol. miner. Resour.* **5,** 1–107.

BRITISH PETROLEUM COMPANY, LTD. 1956. Geological maps and sections of southwest Persia. *Proc. 20th Int. geol. Congr. Mexico 1956.*

CAROZZI, A. 1948. Étude stratigraphique et micrographique du Purbeckien du Jura Suisse. *Archs Sci. Genève*, **1,** 211–375.

ELLIOTT, G. F. 1968. Permian to Palaeocene calcareous algae (Dasycladaceae) of the Middle East. *Bull. Br. Mus. nat. Hist.* (Geol.), Suppl. **4,** 1–111, pls. 1–24.

—— and SÜSSLI, P. 1975. *Imperiella* gen nov., a new alga from the Ruteh Limestone, Upper Permian (Central Alborz Mountains, North Iran). *Eclog. geol. Helv.* **68,** 449–456.

HAGN, H. and OTT, E. 1975. Ein Geröll mit *Elianella elegans* Pfender und Basse (Paleozän, Kalkalpin) aus der subalpinen Molasse N. Salzburg. *Mitt. bayer. St. Paläont. Hist. Geol.* **15,** 119–129.

KOCHANSKY-DEVIDÉ, V. and GUŠIĆ, I. 1971. Evolutions—Tendenzen der Dasycladacean mit besonderer Berücksichtigung neuer Funde in Jugoslawien. *Paläont. Z.* **45,** 82–91.

MASSIEUX, M. 1966. 'Les algues du Nummulitique Égyptien et des terrains Crétacés-Eocènes de quelques régions mésogéennes, par J. Pfender 1940'. Étude de revision par M.M. Pt. 2 Étude critique. *Revue Micropaléont.* **9,** 135–146.

MILANOVIĆ, M. 1965. *Salopekiella*, a new genus of the Dasycladaceae family from the Permian sediments of the Velebit Range. *Acta geol. jugoslav. Akad.* **5,** 373–382.

PRATURLON, A. and RADOIČIĆ, R. 1974. Emendation of genus *Acroporella* (Dasycladaceae). *Geologica romana*, **13,** 17–20.

SEGONZAC, G. 1976. Dasycladacées nouvelles ou peu connues du Thanétien des Pyrénées. *Bull. Soc. Hist. nat. Toulouse*, **112,** 123–136.

VAN BELLEN, R. C. 1959. Tertiary. *In Lexique Strat. Int., Asie*, **10a,** Iraq, 1–333.

G. F. ELLIOTT

Department of Palaeontology
British Museum (Natural History)
Cromwell Road
London SW7 5BD

Manuscript received 13 June 1977
Revised manuscript received 5 October 1977